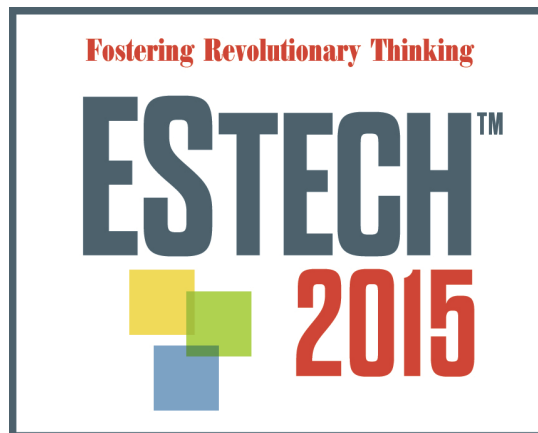


# DEVELOPMENT OF TEST PROTOCOLS FOR INTERNATIONAL SPACE STATION PARTICULATE FILTERS

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# **OBJECTIVES**

**Develop test protocols for ISS filters  
after use  
in storage**

**Develop new test, storage and in use replacement  
protocol**

# **BACKGROUND**

**HEPA-grade filters**

**21 Filters in US segment.**

**Replacement interval between 2-5 years**

**On-orbit frequent vacuuming of face screen.**

**Filters in stock reaching the end of “use life”.**

# **FAILURE MECHANISMS**

**Deterioration of binder in the media**

**Oxidation or loss of volatile constituents in the sealing adhesive**

**Crystallization of the glass fiber media**

# ISS FILTER ELEMENT



S INC. ERS RD. 27889	RESISTANCE (WG)	TEST FLOW	PENETRATION (X)
	.269	70 CFM	.03%
R 22D	FFI ORDER NUMBER : C934091		CUSTOMER ORDER NUMBER : SS523405KM
	MEDIA LOT NUMBER : D07H5214110294		
	SERIAL NUMBER : 283245		

# **FILTER DETAILS**

**Al frame mini pleat HEPA filter  
29" x 4" x 4.375".**

**20-mesh (0.84-mm clear opening) face screen,  
(Nomex™) at inlet;  
aluminum at outlet.**

# TEST SPECIFICATION

**99.9% efficiency @ 0.3 microns @ 70 CFM**

**Mil Std 282**

**IENT RP 001**

**IENT RP 034?**

# **EXPERIMENT**

**Leak testing per IEST RP 034**

**Filters per spec as acquired**

**Failure will show as leak**

**in storage**

**after use**



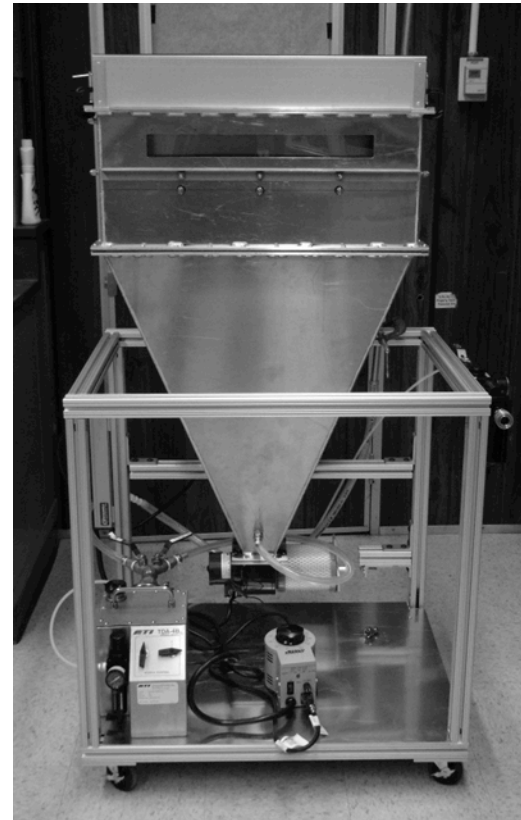
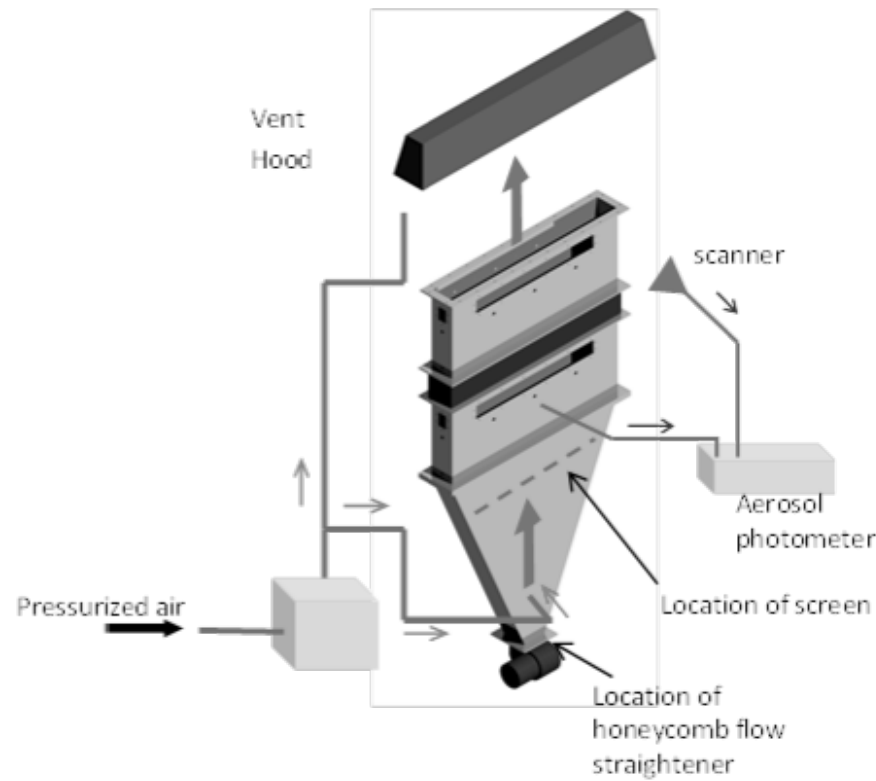
# **TEST SET UP**

**Leak testing**

**RP 034 recommended design**

**Overall efficiency (future needs)**

# NASA GRC FILTER TEST SYSTEM



# TEST INSTRUMENTS

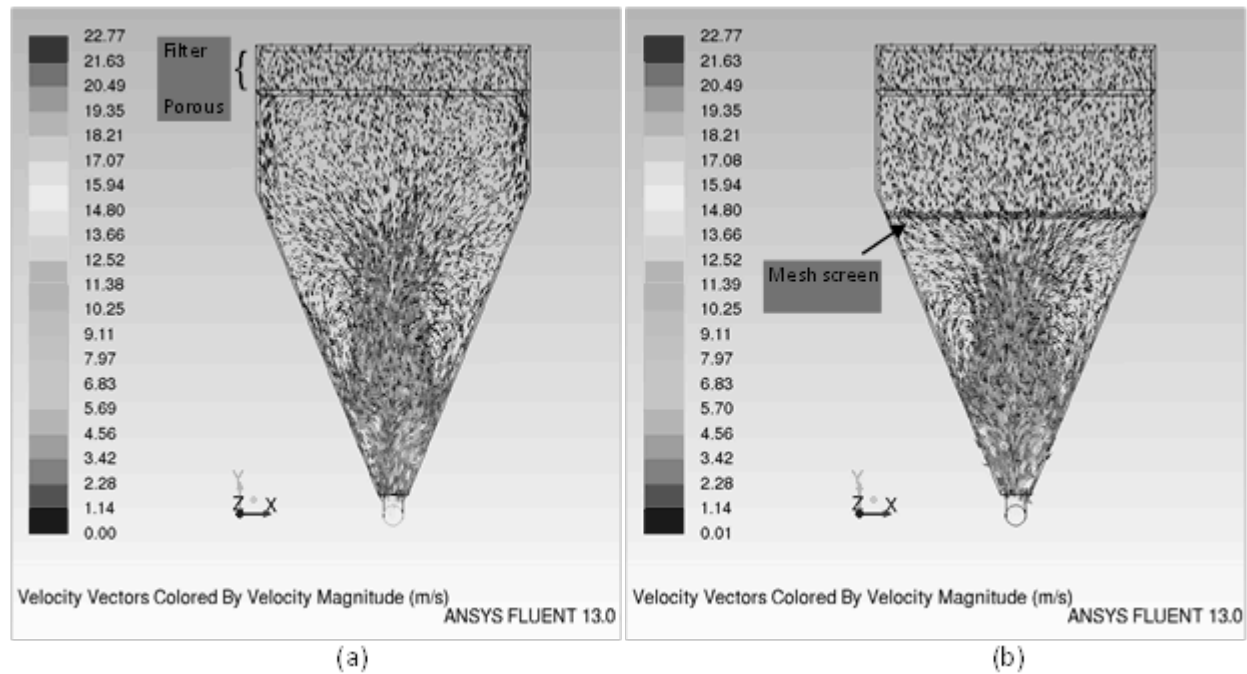


**Laskin Nozzle  
(ATI Model 4B)**

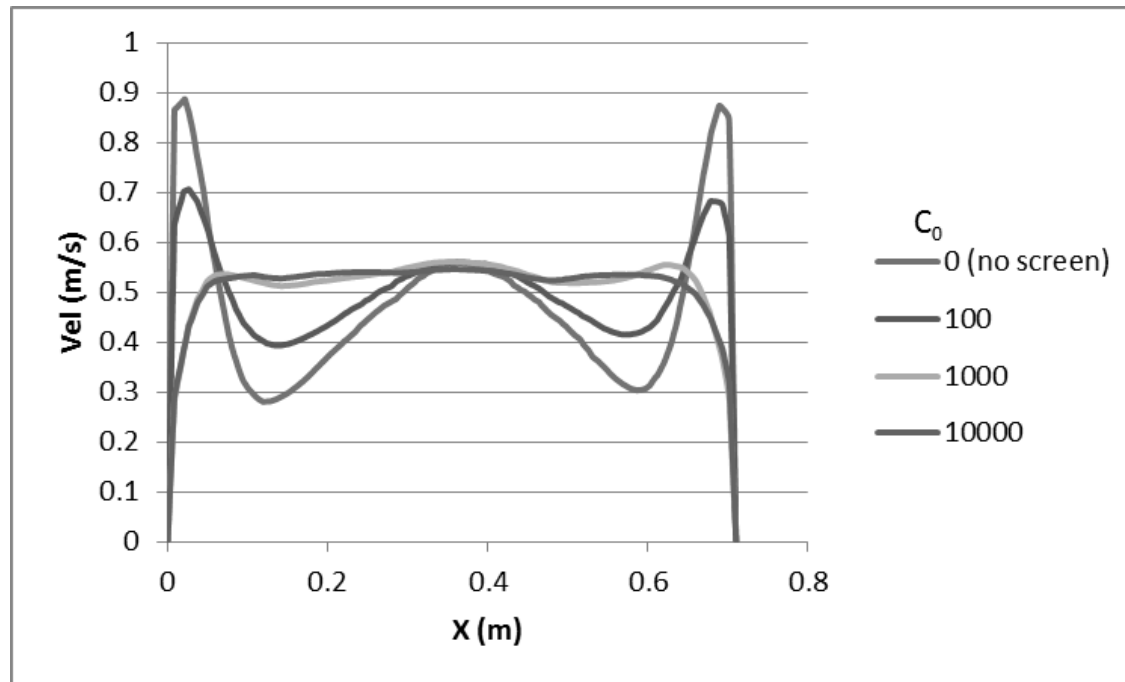


**Photometer  
(TEC Services Model 4B)**

# FLOW MODELING

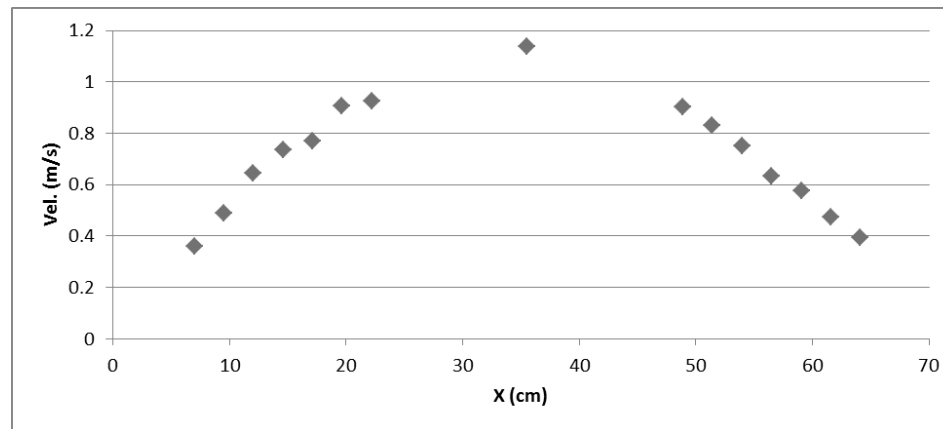


# FLOW MODELING

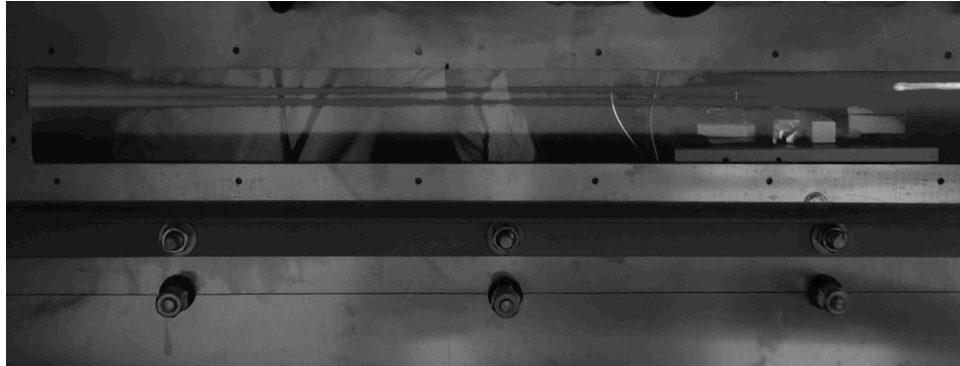


**Good uniformity with screen**

# FLOW AND AEROSOL DISTRIBUTION MEASUREMENTS



# FLOW AND AEROSOL DISTRIBUTION MEASUREMENTS



**Light sheet visual aerosol uniformity**

# **TEST FILTERS**

**One filter from ISS after ~ 1 year use**

**One filter after other engineering evaluations.**



# **LEAK TESTING PRELIMINARY RESULTS**

**Test without Nomex screen**

**Scan entire filter cross-section**

**Follow IEST RP 034 guidelines**

# LEAK TESTING PRELIMINARY RESULTS (CONT.)

## **Filter #1:**

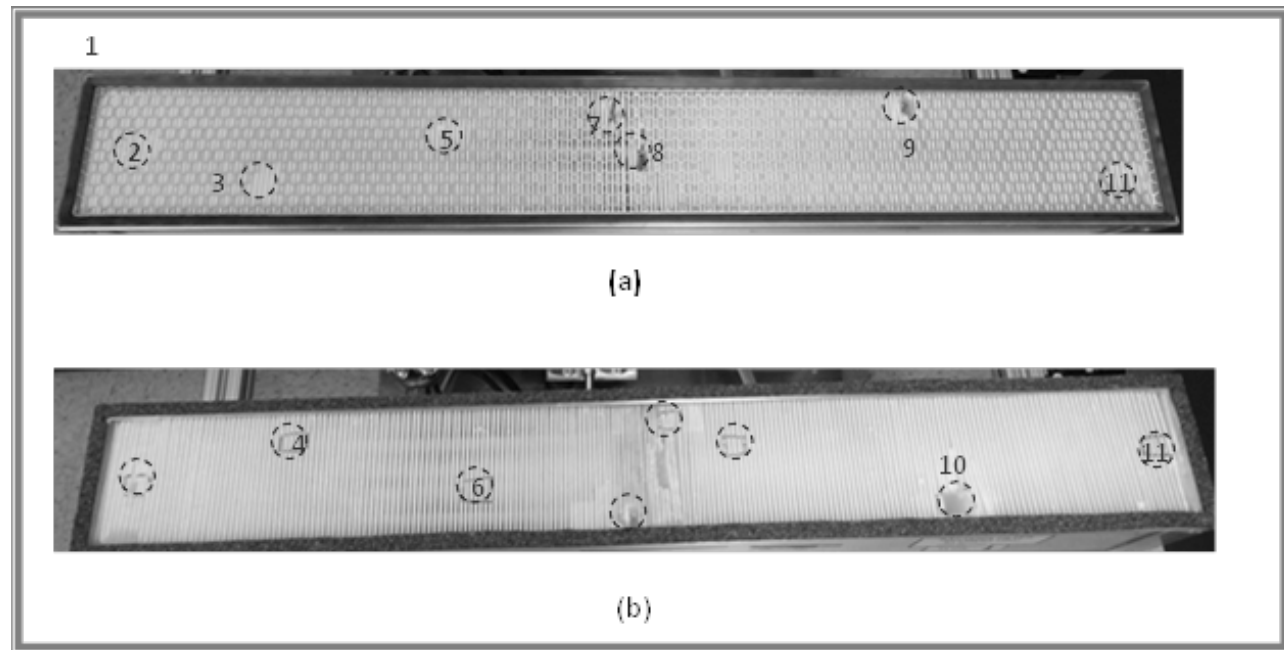
**Nominal penetration 0.2-5% with spikes in the readings as noted below.**

**Several readings did not correlate with known damage.**

**Filter #2: Scans showed values typically <0.001 with incidental readings in the 0.01 range.**

Test point	Location (in cm from LHS)	Measured penetration (%)
1	0 (left edge)	18-20%
2	5	0.0018-0.0021
3	10	0.0008
4	16.8	55.0, 52.4
5	20.3	0.64-0.66
6	28	6.80-7.00
7	34.3	19.0-23.9
8	36.5	47.9-48.5
9	45.7	0.0000
10	58.4	0.0000
11	73.7 (right edge)	0.54, 0.82, 0.93

# LEAK TESTING PRELIMINARY RESULTS (CONT.)



# **SUMMARY**

**Test system met best practice for air and aerosol uniformity**

**Preliminary results indicate ability to detect leak**

**Better ability to validate good filter**

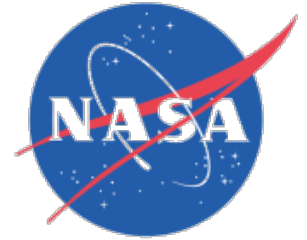
# **FUTURE WORK**

**Improve fidelity of leak testing**

**Modify or develop revised test setup for efficiency testing.**

**Develop NASA acceptance test protocol for filters and test systems**

**Develop revised life and storage criteria.**



# THANK YOU (FINAL) PAGE

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